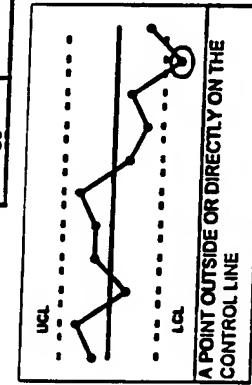


BEST AVAILABLE COPY

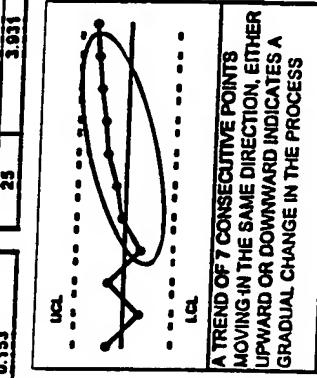
CONSTANTS AND FORMULAS

CONSTANTS AND FORMULAS		FORMULA FOR \bar{X} AND R CHARTS	
		X-Chart	R-Chart
$\bar{X} = \frac{\sum X}{n}$			$CLR = R = \frac{\sum R}{k}$
$CL\bar{X} = \bar{X} = \frac{\sum X}{k}$			$UCLR = D_4 \times R$
$JCL\bar{X} = \bar{X} + (A_2 \times R)$			$LCLR = D_3 \times R$
$LCL\bar{X} = \bar{X} - (A_2 \times R)$			$\hat{\sigma} = \frac{R}{d_2}$
			$C_p = \frac{USL - LSL}{6\hat{\sigma}}$
			$C_{pk} = \text{minimum of } \frac{USL - \bar{X}}{3\hat{\sigma}} \text{ or } \frac{\bar{X} - LSL}{3\hat{\sigma}}$
CONTROL CHARTS FOR VARIABLE DATA			
X	Individual Measurement		
X	Subgroup Average		
X	Grand Average		
E	Sum of		
R	Range = Highest Value - Lowest Value		
Cl.	Center Line		
UCL	Upper Control Limit		
LCL	Lower Control Limit		
X	Number of Subgroups		
n	Subgroup Size		
$\hat{\sigma}$	Process Standard Deviation		
A_2	Factor for \bar{X} Chart Limits		
D_4	Factor for UCL on R Chart		
D_3	Factor for LCL on R Chart		
USL	Upper Specification Limit		
LSL	Lower Specification Limit		
d_2	Factor for estimating Process Standard Deviation		

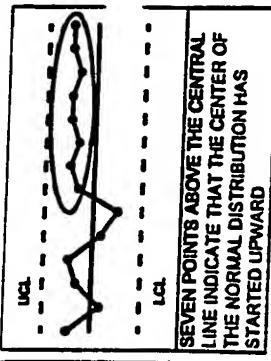
n	Chart X		Range Chart R	
	Subgroup Size	Upper and Lower Control Limit Factor	Subgroup Size	Estimate of Standard Deviation Divisor
2	1.880	1.023	2	1.128
3	1.693	0.729	3	1.693
4	1.574	0.577	4	2.059
5	1.522	0.483	5	2.326
6	1.463	0.419	6	2.514
7	1.419	0.373	7	2.704
8	1.373	0.337	8	2.817
9	1.337	0.308	9	2.970
10	1.308	0.285	10	3.070
11	1.285	0.266	11	3.113
12	1.266	0.249	12	3.216
13	1.249	0.235	13	3.318
14	1.235	0.223	14	3.407
15	1.223	0.212	15	3.472
16	1.212	0.203	16	3.532
17	1.203	0.194	17	3.588
18	1.194	0.187	18	3.640
19	1.187	0.180	19	3.689
20	1.180	0.173	20	3.735
21	1.173	0.167	21	3.776
22	1.167	0.162	22	3.819
23	1.162	0.157	23	3.858
24	1.157	0.153	24	3.895
25	1.153		25	3.931



A POINT OUTSIDE OR DIRECTLY ON THE CONTROL LINE



SEVEN POINTS ABOVE THE CENTRAL LINE INDICATE THAT THE CENTER OF THE NORMAL DISTRIBUTION HAS STARTED UPWARD



SEVEN POINTS BELOW THE CENTRAL LINE INDICATE THAT THE CENTER OF THE NORMAL DISTRIBUTION HAS STARTED DOWNWARD

APPENDIX E